

# Theory & Practice of Criticality Calculations with MCNP5

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## Probable Class Schedule

### Day 1 - AM

#### *Practice:*

##### **1. Introduction**

MCNP5 History, Features, Applications

#### *Theory:*

##### **1. Nuclear Engineering & MC**

Flux, cross-sections, MC, statistics

#### *Practice:*

##### **2. MCNP5 Basics**

Basic Geometry

Cell, Surface, & Data Cards

Running MCNP5 & Plotting

### Day 1 - PM

#### *Theory:*

##### **4. Eigenvalue Calculations - I**

K- and Alpha- Eigenvalue Equations

Power Iteration

Convergence

##### **5. Eigenvalue Calculations - II (part)**

Stationarity Diagnostics

#### *Practice:*

##### **3. Criticality Calculations - I**

Monte Carlo Keff Calculations

K<sub>eff</sub> Estimators & Confidence Intervals

KCODE and KSRC Cards

Random Number Seeds

### Day 3 - AM

#### *Practice:*

##### **7. Tallies & Shielding for Crit-Safety**

Tally Fundamentals - Current, Flux

Shielding Calculations

Statistics

Reaction Rate Tallies

### Day 3 - PM

#### *Practice:*

##### **7. Tallies & Shielding for Crit-Safety**

Dose Rates

Variance Reduction

Spectra & Plotting

Detector Calculations & Crit-Alarms

Dose Fields, Mesh Tallies

Sources & Tallies in Repeated Structures

### Day 2 - AM

#### *Practice:*

##### **4. Advanced Geometry**

Universe & Fill

"Like m But" and TRCL

Lattices & Fill

### Day 2 - PM

#### *Practice:*

##### **5. Criticality Calculations - II**

Convergence

Plotting

Continue Runs

#### *Theory:*

##### **6. Eigenvalue Calculations - III**

Case Studies & Best Practices

#### *Practice:*

##### **7. Case Study #1 – Solution Tanks**

### Day 4

#### *Practice:*

##### **8. Physics & Nuclear Data**

Data Libraries

Plotting

#### *Theory:*

##### **13. Eigenvalue Calculations - IV**

Concerns for loosely-coupled problems

#### *Practice:*

##### **17. Case Study #5**

Fissile Material Storage Vault,

Loosely-coupled Problem

#### *Other Topics, as desired....*

#### *Practice:*

##### **10. Validation**

##### **11. Case Study #3 – Fuel Vault**

##### **13. Merging Tally Results**

##### **15. Reactor Kinetics Parameters**

##### **16. Case Study #4 – Simple TRIGA**

#### *Theory:*

##### **12. Model Uncertainties & Tolerances**

##### **11. Parallel Monte Carlo**

##### **5. Eigenvalue Calculations - II (part)**

##### **7. HTGR Modeling**

##### **8. Temperature Dependence**

##### **10. Monte Carlo Depletion**